

WHAT IS CLAIMED IS:

1. An automatic focus adjustment device comprising:
a light projector for illuminating an object;
an optical system for receiving an image of the
5 object illuminated by said light projector; and
focus adjustment control means for adjusting a
position of said optical system to an in-focus position
by moving said optical system in an optical axis
direction on the basis of an input video signal,
10 wherein said focus adjustment control means
controls an ON/OFF state of said light projector in
accordance with a focus adjustment state with respect to
the object.
2. The device according to claim 1, wherein upon
15 completion of focus adjustment for the object while said
light projector is ON, said focus adjustment control
means inhibits said optical system from being driven
before said light projector is turned off.
3. The device according to claim 2, wherein said focus
20 adjustment control means adjusts the position of said
optical system to the in-focus position by moving said
optical system in the optical axis direction to maximize
a focus evaluation value obtained by extracting a
high-frequency component in the input video signal.
- 25 4. The device according to claim 3, wherein said
optical system includes a focus lens, and said focus

adjustment control means moves said focus lens in the optical axis direction.

5. An image sensing apparatus comprising:

an automatic focus adjustment device of claim 3;

5 image sensing means for sensing an object image obtained via said optical system, and outputting the input video signal; and

recording means for recording a moving or still image of an object on a recording medium in
10 correspondence with the input video signal.

6. The apparatus according to claim 5, wherein said recording means records a still image corresponding to the input video signal on the recording medium upon completion of focus adjustment by said focus adjustment
15 control means.

7. The device according to claim 3, wherein said light projector includes first and second light projection units, and

said focus adjustment control means holds said
20 optical system at the in-focus position with respect to the object even when said second light projection unit is turned on, by moving said optical system by an offset amount of an in-focus position of said optical system arising from different characteristics of light beams
25 emitted by said first and second light projection units, when the position of said optical system is adjusted to

the in-focus position with respect to the object by turning on said first light projection unit.

8. An image sensing apparatus comprising:

an automatic focus adjustment device of claim 7;

5 image sensing means for sensing an object image obtained via said optical system, and outputting the input video signal; and

recording means for recording a moving or still image of an object on a recording medium in
10 correspondence with the input video signal.

9. The apparatus according to claim 8, wherein said image sensing apparatus records a still image corresponding to the input video signal on the recording medium upon completion of focus adjustment by said focus
15 adjustment control means.

10. The device according to claim 3, wherein said light projector includes first and second light projection units,

said device further comprises storage means for
20 pre-storing information related to an offset amount of an in-focus position of said optical system arising from different characteristics of light beams emitted by said first and second light projection units, and

said focus adjustment control means holds said
25 optical system at the in-focus position with respect to the object even when said second light projection unit

is turned on, by acquiring, from said storage means, an offset amount of an in-focus position corresponding to brightness of the object obtained upon turning on said first light projection unit when the position of said optical system is adjusted to the in-focus position with respect to the object by turning on said first light projection unit, and moving said optical system by the acquired offset amount.

11. An image sensing apparatus comprising:
an automatic focus adjustment device of claim 10;
image sensing means for sensing an object image obtained via said optical system, and outputting the input video signal; and
recording means for recording a moving or still image of an object on a recording medium in correspondence with the input video signal.

12. The apparatus according to claim 11, wherein said image sensing apparatus records a still image corresponding to the input video signal on the recording medium upon completion of focus adjustment by said focus adjustment control means.

13. The device according to claim 3, wherein said light projector includes first and second light projection units, and said optical system includes a focus lens and zoom lens,

said device further comprises storage means for

pre-storing information related to an offset amount of an in-focus position of said focus lens upon movement of said zoom lens, and

5 said focus adjustment control means holds said optical system at the in-focus position with respect to the object by acquiring, from said storage means, an offset amount of an in-focus position corresponding to the current position of said zoom lens when the position of said optical system is adjusted to the in-focus
10 position with respect to the object by turning on said first light projection unit, and moving said focus lens by the acquired offset amount.

14. An image sensing apparatus comprising:

 an automatic focus adjustment device of claim 13;
15 image sensing means for sensing an object image obtained via said optical system, and outputting the input video signal; and

 recording means for recording a moving or still image of an object on a recording medium in
20 correspondence with the input video signal.

15. The apparatus according to claim 14, wherein said image sensing apparatus records a still image corresponding to the input video signal on the recording medium upon completion of focus adjustment by said focus
25 adjustment control means.

16. An image sensing apparatus comprising:

a light projector for illuminating an object;
an optical system for receiving an image of the
object illuminated by said light projector;

image sensing means for sensing an object image
5 obtained via said optical system, and outputting the
input video signal;

focus adjustment control means for adjusting a
position of said optical system to an in-focus position
by moving said optical system in an optical axis
10 direction on the basis of the video signal output from
said image sensing means; and

recording means for recording a moving or still
image of an object on a recording medium in
correspondence with the input video signal,

15 wherein said focus adjustment control means turns
on/off said light projector in synchronism with a
vertical sync signal of the video signal and sets an ON
period of said light projector at an integer multiple of
a vertical sync period of the video signal upon
20 executing focus adjustment with respect to the object.

17. The apparatus according to claim 16, wherein said
focus adjustment control means turns on/off said light
projector in synchronism with the vertical sync signal
of the video signal, sets an ON period of said light
25 projector twice the vertical sync period of the video
signal, and sets an OFF period of said light projector

to be equal to the vertical sync period of the video signal, upon executing focus adjustment with respect to the object.

18. The apparatus according to claim 17, wherein said
5 focus adjustment control means adjusts the position of said optical system to the in-focus position in accordance with an average value of focus evaluation values obtained during a period three times the vertical sync period.

10 19. The apparatus according to claim 16, wherein upon completion of focus adjustment for the object while said light projector is ON, said focus adjustment control means inhibits said optical system from being driven before said light projector is turned off.

15 20. A focus adjustment method having the focus adjustment step of adjusting a position of an optical system to an in-focus position by moving said optical system, which receives an image of an object illuminated by a light projector, in an optical axis direction of
20 said optical system on the basis of an input video signal, comprising the step of:

controlling an ON/OFF state of said light projector in accordance with a focus adjustment state with respect to the object.

25 21. The method according to claim 20, wherein upon completion of focus adjustment for the object while said

light projector is ON, the focus adjustment control step includes the step of inhibiting said optical system from being driven before said light projector is turned off.

22. The method according to claim 21, wherein the
5 position of said optical system is adjusted to the in-focus position by moving said optical system in the optical axis direction to maximize a focus evaluation value obtained by extracting a high-frequency component in the input video signal.

10 23. The method according to claim 22, wherein said light projector includes first and second light projection units, and

the focus adjustment control step includes the step of holding said optical system at the in-focus position
15 with respect to the object even when said second light projection unit is turned on, by moving said optical system by an offset amount of an in-focus position of said optical system arising from different
characteristics of light beams emitted by said first and
20 second light projection units, when the position of said optical system is adjusted to the in-focus position with respect to the object by turning on said first light projection unit.

24. The method according to claim 22, wherein said
25 light projector includes first and second light projection units,

information related to an offset amount of an
in-focus position of said optical system arising from
different characteristics of light beams emitted by said
first and second light projection units is pre-stored in
5 a memory, and

the focus adjustment control step includes the
steps of:

holding said optical system at the in-focus
position with respect to the object even when said
10 second light projection unit is turned on, by acquiring,
from said memory, an offset amount of an in-focus
position corresponding to brightness of the object
obtained upon turning on said first light projection
unit when the position of said optical system is
15 adjusted to the in-focus position with respect to the
object by turning on said first light projection unit,
and

moving said optical system by the acquired offset
amount.

20 25. The method according to claim 22, wherein said
light projector includes first and second light
projection units, and said optical system includes a
focus lens and zoom lens,

information related to an offset amount of an
25 in-focus position of said focus lens upon movement of
said zoom lens is pre-stored in a memory, and

the focus adjustment control step includes the step of holding said optical system at the in-focus position with respect to the object by acquiring, from said memory, an offset amount of an in-focus position
5 corresponding to the current position of said zoom lens when the position of said optical system is adjusted to the in-focus position with respect to the object by turning on said first light projection unit, and moving said focus lens by the acquired offset amount.

10 26. A focus adjustment method for an image sensing apparatus which illuminates an object by a light projector, senses an image of the illuminated object input via an optical system using an image sensing element, and records a moving or still image of the
15 object on a recording medium in correspondence with a video signal output from said image sensing element,

wherein the focus adjustment step of adjusting a position of said optical system to an in-focus position with respect to the object includes the step of turning
20 on/off said light projector in synchronism with a vertical sync signal of the video signal when said optical system is moved in an optical axis direction to maximize a focus evaluation value obtained by extracting a high-frequency component from the video signal output
25 from said image sensing element, and setting an ON period of said optical system at an integer multiple of

a vertical sync period of the video signal.

27. The method according to claim 26, wherein the focus adjustment control step includes the step of turning on/off said light projector in synchronism with the vertical sync signal of the video signal, setting an ON period of said light projector twice the vertical sync period of the video signal, and setting an OFF period of said light projector to be equal to the vertical sync period of the video signal.

28. The method according to claim 27, wherein the focus adjustment control step includes the step of adjusting the position of said optical system to the in-focus position in accordance with an average value of focus evaluation values obtained during a period three times the vertical sync period.

29. The method according to claim 26, wherein upon completion of focus adjustment for the object while said light projector is ON, the focus adjustment control includes the step of inhibiting said optical system from being driven before said light projector is turned off.

30. A computer-readable storage medium which stores a program code of automatic focus adjustment for adjusting a position of an optical system, which receives an image of an object illuminated by a light projector, to an in-focus position by moving said optical system in an optical axis direction of said optical system on the

basis of an input video signal, having:

a code of the focus adjustment step of controlling an ON/OFF state of said light projector in accordance with a focus adjustment state for the object.

5 31. The medium according to claim 30, wherein the code of the focus adjustment control step inhibits, upon completion of focus adjustment for the object while said light projector is ON, said optical system from being driven before said light projector is turned off.

10 32. The method according to claim 31, wherein the code of the focus adjustment control step adjusts the position of said optical system to the in-focus position by moving said optical system in the optical axis direction to maximize a focus evaluation value obtained
15 by extracting a high-frequency component in the input video signal.

33. The medium according to claim 31, wherein said light projector includes first and second light projection units, and

20 the code of the focus adjustment control step holds said optical system at the in-focus position with respect to the object even when said second light projection unit is turned on, by moving said optical system by an offset amount of an in-focus position of
25 said optical system arising from different characteristics of light beams emitted by said first and

second light projection units, when the position of said optical system is adjusted to the in-focus position with respect to the object by turning on said first light projection unit.

- 5 34. The medium according to claim 31, wherein said light projector includes first and second light projection units, and

the code of the focus adjustment control step holds said optical system at the in-focus position with
10 respect to the object even when said second light projection unit is turned on, by acquiring, from a memory which pre-stores information related to an offset amount of an in-focus position of said optical system arising from different characteristics of light beams
15 emitted by said first and second light projection units, an offset amount of an in-focus position corresponding to brightness of the object obtained upon turning on said first light projection unit when the position of said optical system is adjusted to the in-focus position
20 with respect to the object by turning on said first light projection unit, and

moving said optical system by the acquired offset amount.

35. The medium according to claim 31, wherein said
25 light projector includes first and second light projection units, and said optical system includes a

focus lens and zoom lens, and

the code of the focus adjustment control step holds said optical system at the in-focus position with respect to the object by acquiring, from a memory which
5 pre-stores information related to an offset amount of an in-focus position of said focus lens upon movement of said zoom lens, an offset amount of an in-focus position corresponding to the current position of said zoom lens when the position of said optical system is adjusted to
10 the in-focus position with respect to the object by turning on said first light projection unit, and moving said focus lens by the acquired offset amount.

36. A computer-readable storage medium which stores a program code of automatic focus adjustment in an image
15 sensing apparatus which illuminates an object by a light projector, senses an image of the illuminated object input via an optical system using an image sensing element, and records a moving or still image of the object on a recording medium in correspondence with a
20 video signal output from said image sensing element,

wherein a code of the focus adjustment step of adjusting a position of said optical system to an in-focus position with respect to the object turns on/off said light projector in synchronism with a
25 vertical sync signal of the video signal when said optical system is moved in an optical axis direction to

maximize a focus evaluation value obtained by extracting
a high-frequency component from the video signal output
from said image sensing element, and sets an ON period
of said optical system at an integer multiple of a
5 vertical sync period of the video signal.